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The Future of Information Technology and Academic Medical Centers: Planning for Integration

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and Academic Medical Centers: Planning for Integration

by Rob Aken and Patty Powell

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A contemporary researcher in health planning writes that "what
the future holds is not 'out there' in 2010 waiting to happen;
nor is it 'in there' in a black box shaped like a computer.
Rather, the future will emerge from choices made yesterday, now,
and in the decades ahead..." Choices have been made in the last
few years that will have significant effects on the academic
medical centers of the 21st century. These choices involve
educational, research, and clinical priorities as well as
networking and data access possibilities for connecting
individuals to the massive volume of data stored in departmental,
institutional, and national databases.

The recent General Professional Education of the Physician (GPEP)
Report (published by the AAMC in 1984), "Physicians for the 21st
Century," concludes that medical students can no longer be
expected to become and remain knowledgeable in all of the diverse
areas of medical research; instead they must become "problem-
solvers" skilled at accessing and linking up-to-date medical
research and information with patient problems. The rapid
changes taking place in medical knowledge often have
ramifications for the entire field, yet the narrowing of
specialization makes awareness of the broad spectrum of data an
increasingly difficult task. Clinical databases are now available
providing patient-specific information; and increasingly, specific hospital, state, regional, and national databases are becoming available from the same terminal providing bibliographic and comparative data for both research and clinical applications. Preparing physicians to take full advantage of information access will necessitate teaching them the nuances of applicable technologies for use in clinical practice and research. When medical students use information tools throughout their training, they will be prepared to use them in the practice of their profession, and expect to find them available regardless of where they practice. Universal access will permit clinicians to take their academic training with them regardless of where they go.

As yet, many academic institutions are just beginning to think about training medical students to use new information technologies that access new computer-based knowledge databases, computer-enhanced graphically displayed diagnostic information, and current on-going research. A few medical colleges are leading the way. Cornell University Medical College provides access to text, slides, photographs, and x-rays through terminals in student dormitories. This data is linked and made easily accessible to the student via video disk storage and "hypermedia." The simple commands of hypermedia programs allow students to examine related data without consulting indexes or going through complex search protocols. Another area of activity with knowledge databases involves "decision support systems," which will aid in patient diagnosis. Two of the colleges already involved in decision support systems are the University of
Vermont (with its PROMIS system) and the Indiana School of Medicine (with its CARE system). A decision support system is a productivity tool and is used to improve routine day-to-day operations of data entry, updates, and displays, but it is loosely structured and allows the user to select and define procedures as needed. (A generic example of this type of system is a database manager or spreadsheet program.) The more sophisticated diagnostic and therapeutic decision support systems, then, are algorithm generators. As decision support systems become more refined and embody additional layers of reasoning, they will develop beyond algorithm generators and more closely resemble the expert systems of Artificial Intelligence (AI).

An example of the current computer-enhanced diagnostic information technology that uses graphics is PACS (Picture Archival and Communications Systems). PACS workstations allow computerized storage and simple retrieval and transmission of radiologic or cardigraphic images via telephone lines, microwave signals, or satellite dishes.

New methods for collecting and accessing ongoing research data are being developed at some academic institutions. At the University of Kentucky, the Markey Cancer Center has developed the Cancer Patient Data Management System. Information about cancer cases is periodically collected in other regions of the country as part of the National Cancer Registry, but Kentucky's system allows any state hospital to immediately compare results on a state level. The system is geared toward helping physicians
treat their cancer patients as well as providing data for ongoing research.

The educational priorities emphasizing the training of physicians as problem solvers (outlined in the GPEP Report) have led to the implementation of these new teaching methods. The new methods I've been describing enhance the development of the individual's problem-solving skills. The technology has finally developed to the point that physician instructors can easily write CAI and hypermedia programs, so the adoption of the new technologies in the academic medical centers should begin to mushroom. An October 3rd NEWSWEEK article describes "Electric Cadaver," an interactive hypermedia package that allows beginning students to perform experiments without any real-world consequences, is one indication of the current widespread popularity of this new emphasis on individualized learning. Developments like Steven Jobs' new hypermedia package, NeXT, will likely speed-up the use of hypermedia in a wide variety of academic settings.

Not only are teaching methods changing from an emphasis on large group lectures to more individualized CAI, but the location of training has changed, too. Health sciences education continues to be "directed" from the academic centers, but more and more of the educational experience is now taking place anywhere one can find telephone lines. Modems connect local terminals to mainframes at academic centers; microwave systems inexpensively link downloaded satellite programs throughout local educational facilities. More academic health sciences faculty are being
dispersed to regional settings and more local practicing physicians are utilized as clinical role models and preceptors. Indeed, the federally funded Area Health Education Centers (AHEC) Program, which began in 1974, for the training of medical students, medical residents, and other allied health professionals, is now in place statewide in 23 states.

The dispersal of academic training and trainers to more geographically remote areas helps to solve the health manpower shortages there (both in the U.S. and worldwide). In addition, academic faculty based away from the academic center carry on their traditional research responsibilities at the local base. They communicate with and send and receive raw data to other researchers and databases both nationally and internationally via new technologies. The benefits of the local research and knowledge of the local researchers should have immediate impact on the local community of students, practicing physician/preceptors, and patients. The locally-based researchers will play an important role in the continuing, or rather continuous education, of health professionals at their local site. Major changes in information technology (e.g. Artificial Intelligence, Hypermedia, microwave-satellite links) will continue, and they will continue to enhance all of these arenas of activity.

Adjustments to the mechanics of the new technologies will take time, partly because of traditional resistance to change and partly because of the variety of systems currently in use. In the short run, the complexity of many of the searching tools will
continue to increase along with the volume of data they can access. Information specialists, including librarians and computer specialists, can help ease the transition, sharing their knowledge of information access techniques and working with the medical team to access and filter this barrage of data.

In the long run, however, we would do well to follow the recommendations of the Association of American Medical Colleges (AAMC) Steering Committee on the Evaluation of Medical Information Science in Medical Education. The AAMC committee finds medical informatics "basic to the understanding and practice of modern medicine" and therefore recommends that they become an integral part of the medical curriculum. (The term "medical informatics" describes the broad array of information tools being developed for medical applications.) The AAMC committee also recommends that each medical center have a "locus of activity for medical informatics to foster research, integrate instruction, and encourage appropriate use." One possibility for this "locus of activity" would be the library, which is already involved in this work to a large extent.

The steering committee recommended that the National Library of Medicine (NLM) be the focus of federal activity and be responsible for training, career development, and research support. This is clearly getting started with NLM's IAIMS (pronounced I-AIMS) project (which I'll discuss in a moment), as well as NLM's TIME center (Technical Innovations in Medical Education), and its proposed Centers of Excellence in Medical Informatics, which would act as consultant groups providing
practice-linked automated information assistance.

Within this framework the AAMC Steering Committee sees a changing role for medical educators, one that has positive pedagogical ramifications: educators will become "guides to, rather than sources of, information."

The National Board of Medical Examiners is also taking advantage of the new technologies with CBX (Computer Based Exams), using "simulations of direct patient care" in their exams. Students will need to be prepared to use this equipment for both certification and practice.

Integrating all of these available and forthcoming services (educational applications, research possibilities, and clinical uses) will require a united approach to networking and remote access. How can individual practitioners, wherever they are located, sit down at their office terminals and access their university's academic faculty, CAI programs, academic library system, and research databases, as well as those of other universities worldwide?

The Integrated Academic Information Management Systems (IAIMS) is a National Library of Medicine program to assist health-related schools, organizations, and libraries to plan, develop, and implement computer systems that make it easy for health care workers to gain access to information they need for problem-solving and learning. A computer based network of databases for patient records, medical images, and the latest information in journals and textbooks would be online and accessible from home,
office, or hospital bedside at any time of the day or night.
The IAIMS concept was originally described in a study developed by the Association of American Medical Colleges (AAMC) in its 1982 report titled "Academic Information in the Academic Health Sciences Center" often referred to as the "Matheson Report." The report recommended that federal and non-federal agencies "should support (a) the development of prototype network systems, (b) programs that encourage the rapid integration of information technologies in the learning and practice of the health professions, and (c) programs that attract and retain qualified people in medical information and knowledge-base development in academic centers.

The first part of the recommendation, (a) developing networks, was given top priority by the National Library of Medicine (NLM), who sponsored the AAMC study and its Matheson Report. NLM began funding an IAIMS grant program in 1983. These federal funds contribute approximately one third of total costs; support from the private sector and from institutions has supplemented the NLM monies. The grant program's primary objectives are to develop (over at least a 10 year period) comprehensive, integrated information networks of computer-based systems and services in academic institutions, and to apply such systems to advancing health science education, research, patient care and management. So far, twelve IAIMS planning and model development projects have been funded at: Rhode Island Hospital, the Univ. of Pittsburgh, Duke University, the University of Cincinnati, the American College of OBGYN, Baylor College of Medicine, Columbia
University, Georgetown University, Harvard University, Johns Hopkins University, the University of Maryland, and the University of Utah.

A close partner of NLM and the AAMC in the IAIMS project has been the Association of Academic Health Sciences Library Directors. This group, in June 1988, cosponsored with the Medical Library Association, a lunch and IAIMS "show-and-tell" (for selected members and staff of the U.S. House and Senate) to lobby for continued federal support in 1989-93. (Academic institutions should also plan funding strategies, including lobbying federal agencies.) The Association of Academic Health Sciences Library Directors demonstration emphasized that IAIMS is a method of planning and developing models and approaches to health care knowledge management which will:

- improve efficiency of health care delivery
- improve pathways to information
- improve research productivity.

"Institutional planning for the rapid integration of information systems in academic health centers can have an early impact on educational processes and provide a basis for incorporating medical information science research applications and instruction." Donald Lindberg, MD, NLM Director

Projections concerning the effects of as yet to be developed technologies include, by their very nature, assumptions concerning details that may get lost in the implementation. Yet we stand on the planning side of that future, with the opportunity to shape the way these technologies will be applied in academic medical centers, and can therefore examine those
possibilities with an eye toward the integration of a number of diverse systems. The need for standardization and uniform policies and procedures is critical to the efficient use of the marvelous equipment we will (see?) (discuss?) here today. This standardization will necessarily take place on institutional, state, and regional levels, but given the possibilities of national databanks, we have a clear focal point in the National Library of Medicine.

Through the installation of common, compatible systems, an integrated network can provide access to an incredible body of knowledge at any site, no matter how remote, that has a link to the network.

To foster the growth of compatible systems, the planners of 21st century academic medical information centers should encourage industry to develop innovations that have flexible interface capabilities and are geared toward the needs of the profession rather than to the available technologies. A recent study by the Special Resource Committee on Medical School Libraries of the Association of Canadian Medical Colleges and the Canadian Health Libraries Association recommends that the country's medical schools form "Information Management Councils" at each institution, made up of the medical school library director, the computing center director, and senior representatives from each of the departments participating in the function of the system. The changes in information access in academic medical centers, by the way, have campus-wide implications, particularly in regard to standardizing communications and access. The Information
Management Councils will need to anticipate changes in the technologies and apply them to the needs of the profession by merging them with current capabilities. These technological changes will necessarily include national network and protocol standards. Within the framework of these national standards, each institution will assess its own resource requirements and develop a clear implementation plan that includes a workable transition from the current technological environment to the future. The Canadian Information Management Council concept provides us with a model as we deal with these changes in our own country; it also has clear implications for further integration on the international level. Regardless of the model, we will all be engaged in an exciting cooperative planning venture in the years ahead.